In re Patent Application of:
YAO
Serial No. **10/736,859**
Filed: **12/16/2003**

REMARKS

Prior to the present amendment, claims 6-9 and 11-18 were pending in the present application, with claims 1-5 and 10 having been cancelled by way of applicant's amendment filed October 12, 2005.

By the present amendment, claims 14 and 15, which have been withdrawn from consideration as being directed to a non-elected invention, have been cancelled without prejudice to applicant's right to file a separate divisional application directed to the subject matter embodied therein.

In addition, examined claims 6-9, 11-13 and 16-18 have been replaced by new claims 19-40. As such, claims 19-40 are currently pending in the present application.

The wording of replacement claims 19-40 has been drafted in an effort to eliminate the informalities noted in item 1 on page 2 of the Final rejection of December 27, 2005, and to employ terminology that is believed to particularly point out and distinctly claim subject matter which is neither disclosed nor suggested by the cited prior art. As a result, each of the rejections tendered in items 3 and 5, set forth on pages 2-5 of the Final rejection of December 27, 2005, is respectfully traversed, and applicant respectfully requests favorable reconsideration of the present application in light of the language of replacement claims 19-40 and the discussion to follow.

Of replacement claims 19-40, claims 19-29 define the invention from a standpoint of the opto-electronic conversion methodology that is performed by abutting doped and intrinsic

light absorbing semiconductor layers, parameters of which are particularly delineated.

Claims 30-40 define the structure and behavioral properties of the doped and intrinsic semiconductor layers that make up a photodiode structure, which produces the electrical photocurrent in response to incident light absorbed thereby.

Neither the methodology of claims 19-29 nor the photodiode structure of claims 30-40 is disclosed or suggested by the prior art document cited in the outstanding office action.

More particularly, each of independent replacement claims 19 and 30 defines the fact that, in accordance with the present invention, each of a light absorption intrinsic semiconductor layer and an abutting light absorption doped semiconductor layer produces electrical carriers in response to light absorbed thereby. In the elected embodiment of the invention shown in Figure 1, the doped absorption layer may comprise either of a p-doped semiconductor layer 20 or an n-doped semiconductor layer 40. These respective doped semiconductor layers abut respectively different (first and second) surfaces of the light absorption intrinsic semiconductor layer 30 therebetween. P-doped electrodes adjoin surfaces of the light absorption doped semiconductor layers 20 and 40, to provide respective anode and cathode electrodes for extracting the electrical current that is generated by the doped and intrinsic semiconductor layers in response to light incident thereon.

Looking now at the prior art cited in the outstanding office action, the U.S. Patent to Goossen et al, 4,904,859, discloses an optically bistable switching device comprised of a self electrooptic effect device (SEED). Goossen et al's SEED structure, which is diagrammatically illustrated, for example, in

Figure 1 of the drawings of the patent, includes an undoped quantum well region 114, on either side of which are respective intrinsic or nominally doped spacer regions 113 and 115, which space the quantum well region 114, in which light is absorbed, from a pair of doped contact regions 111 and 112, to which contact pads 116 and 117 are respectively affixed.

A careful review of the entirety of the descriptive text of the patent to Goossen et al reveals that the patentees describe light absorption and photocurrent generation occurring only within the quantum well region 114. Attention may be directed, for example, to the description in column 1, lines 23-29, wherein the patentees describe that the application of an electric field perpendicular to the quantum well layers permits electro absorption by the quantum-confined Start effect (QCSE), with the absorption band edge including any sharp exciton resonance peaks being shifted to lower photon energy to achieve transmission changes of approximately 50%. For the particular device shown in Figure 1, Goossen et al describe, in column 4, lines 29-32, that the addition of more than one period of the symmetric quantum well permits increased enhancement of the absorption coefficient. Namely, in Goossen et al's device, the absorption of light takes place within the quantum well region 114.

Thus, contrary to what is alleged in the Final rejection of December 27, 2005, nowhere in their patent do Goossen et al describe that either or both of the n+ contact region 112 and the p+ contact region 111 absorbs light and produces photocurrent in response to such light absorption. Rather, from the plain import of the patent, regions 111 and 112 are not quantum well regions, but serve as contact regions, upon which the electrical contacts 116 and 117 are formed.

In contradistinction thereto, in accordance with the definition of the invention in each of replacement independent claims 19 and 30, the doped semiconductor layer or layers (20/40) formed on a first, or first and second, surfaces of the intrinsic semiconductor layer (30) are operative to absorb light and to produce, in response to that absorbed light, electrical carriers.

In item 3, on pages 2 and 3, and further discussed in item 6, on page 5, of the Final Rejection of December 27, 2005, light absorption functionality has been attributed to the doped contact regions 111 and 112 of the structure of Goossen et al. Applicant respectfully submits that such attribution is inaccurate.

In the first place, as noted above, nowhere in the patent text is there any disclosure or suggestion that either or both of the contact regions 111 and 112 absorbs light and produces electrical carriers in response to such (non-existing) absorption of light. Secondly, the suggestion that the contact regions 111 and 112 of Goossen et al inherently absorb light is inconsistent with the intended purpose of the structure of Goossen et al, which is to operate as a device for modulating or controlling the transmission of light therethrough. As one skilled in electrooptic technology is aware, a light-modulating device, when controlled so as to be transmissive to light, (in its ON state) is intended to pass as much light as possible therethrough; on the other hand, when controlled in a light-blocking mode(in its OFF state), the light-modulating device is intended to absorb as much light as possible.

As pointed out above, and as described by Goossen et al, absorption of light occurs only in quantum well region 114. There is no disclosure that there is any light absorbed by either of the doped contact regions 111 and 112. In fact, if such contact regions (111, 112) absorbed light, any light passing

therethrough would be continuously lost, since these regions would be absorbing all the time. Such an operation is counterproductive to the intended operation of Goossen et al's modulator. From the clear import of the text of Goossen et al, neither of the doped contact regions 111 and 112 is, nor is it intended to be, light-absorbing and producing a photocurrent in accordance with such light absorption.

The comments made in paragraph 6, on page 5 of the final rejection are confusing, to say the least. For example, the third and fourth sentences of the main paragraph of item 6 read as follows:

> "Light enter as a beam 104 into layer 111, and emerges as light 105 out of layer 105. Clearly, semiconductor layer 104 admits the light so that the light may emerge through layer 105."

First of all, in Goossen et al's device, there is no layer 105. Reference numeral 105 refers to the light beam that exits the device by way of the contact surface region 112. Also, there is no semiconductor layer 104. The reference numeral 104 refers to the light beam that enters the surface of the contact region 111. As pointed out above, Goossen et al's depiction of entrance and exit beams 104 and 105 is consistent with the descriptive text that the device is intended for light modulation, as the light beam is permitted to pass through or is controllably inhibited from passing through the semiconductor device 110. Control of such light modulation is by way of only the quantum well region 114.

The secondary reference to Jang et al has been cited for its disclosure, in line 3 of the first paragraph of page 173, that InGaAs, that is lattice-matched to InP, may be used for the absorption regions of a photodetector. However, such a statement

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by the authors, which is not disputed by applicant, is not a disclosure or suggestion to modify a modulator structure of the type disclosed in the patent to Goossen et al to result in a methodology or photodiode structure upon which applicant's claims would read. Like the patent to Goossen et al, the article to Jang et al contains no disclosure or suggestion of producing a photocurrent in response to absorption of light by a doped semiconductor layer that abuts a photocurrent producing, light-absorptions intrinsic semiconductor layer, as particularly delineated in claims 19-40.

In the absence of a citation of prior art, which teaches or suggests the invention as more concisely defined in replacement claims 19-40, favorable reconsideration of this application and a notice of allowability of claims 19-40 are earnestly solicited.

Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees, to Deposit Account No. 50-1465 and please credit any excess fees to such deposit account.

Respectfully submitted,

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CERTIFICATE OF FACSIMILE TRANSMISSION

I HEREBY CERTIFY that the foregoing correspondence has been forwarded via facsimile number **571-273-8300** to MAIL STOP RCE, COMMISSIONER FOR PATENTS, this 8 day of March 2006.